

22/11/2012

2nd Half-12 mina-(b)-73

Con. 7584-12.

KR-4931

(3 Hours)

[Total Marks : 100]

- N. B. :**
- (1) Question No. 1 is **compulsory**.
 - (2) Attempt any **four** questions out of the remaining **six** questions.
 - (3) **Figures** to the **right** indicate **full** marks.
 - (4) Assume **suitable** data wherever **required** but justify the **same**.
 - (5) Answer to the questions should be **grouped** and written **together**.

1. Solve any **four** :—

20

- (a) Which of the two assumptions, uniform intensity of pressure or uniform rate of wear would you make use of in designing friction clutch and why ?
- (b) Explain the application of gyroscopic principles to aircrafts.
- (c) Why a roller follower is preferred to that of a knife edged follower ?
- (d) Differentiate between Plate clutch and Cone clutch.
- (e) The length of the upper arm of a watt governor is 400 mm and its inclination to the vertical is 30° . Find the percentage increase in speed, if the ball rises by 20 mm.

2. (a) The mass of each ball of a Hartnell governor is 1.4 kg. The length of ball arm of the bell crank lever is 100 mm whereas the length of the arm towards sleeve is 50 mm. The distance of the fulcrum of bell crank lever from the axis of rotation is 80 mm. The extreme radii of rotation of the balls are 75 mm and 112.5 mm. The maximum equilibrium speed is 6% greater than the minimum equilibrium speed which is 300 rpm.

Determine : —

- (i) Stiffness of the spring
- (ii) Equilibrium speed when radius of rotation of the ball is 90 mm. Neglect the obliquity of the arms.

- (b) A 4-wheel trolley of mass 2500 kg. runs on rails, which are 1.5 m apart and travels around a curve of 30 m radius at 24 km/h. The rails are at the same level. Each wheel of the trolley is 0.75 m in diameter and each of the two axles is driven by a motor running in a direction opposite to that of the wheels at a speed of five times the speed of rotation of the wheels. The M. I. of each axle with gear and wheels is $18 \text{ kg} - \text{m}^2$. Each motor with the shaft and the gear pinion has M. I. of $12 \text{ kg} - \text{m}^2$. The C. G. of the car is 0.9 m above the rail level. Determine the Vertical Forces exerted by each wheel on the rails taking into consideration the centrifugal and gyroscopic effects.

3. (a) In a band and block brake, the band is lined with 14 blocks, each of which subtends an angle of 20° at the drum centre. One end of the band is attached to the fulcrum of the brake lever and the other to a pin 150 mm from the fulcrum. Find the force required at the end of the lever 1 metre long from the fulcrum to give a torque of $4 \text{ kN} - \text{m}$, for both clockwise and anticlockwise rotation of the drum. The diameter of the brake drum is 1 metre and coefficient of friction between the blocks and the drum is 0.25.

[TURN OVER]

- (b) Explain watt governor with its limitation. What are the effects of friction and of adding a central weight to the sleeve of a watt governor? 6
- (c) Show that in a Porter governor, 6

$$\text{coefficient of insensitiveness} = \frac{F}{(m + M)g}$$

Where, F is the frictional force at the sleeve,

m is the mass of each ball,

M is the mass on the sleeve.

Assume $q = 1$.

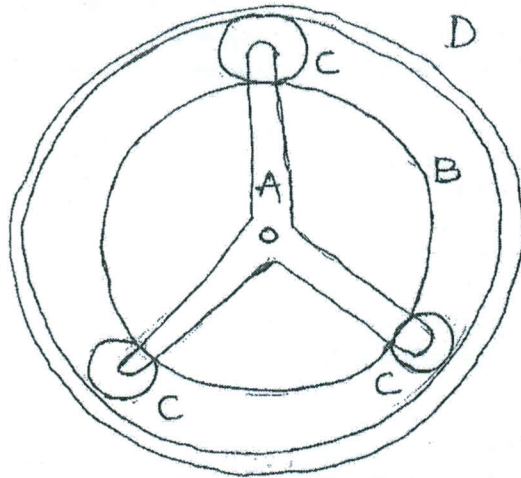
4. (a) Explain the terms self-energizing and self-locking with respect to differential band brake. Also discuss about the direction of the force applied at the end of the lever and the tensions in the band when the drum rotates in the clockwise and anticlockwise direction. 10
- (b) A car moving on a rough inclined plane is having the following data :— 10
- angle of inclination of the plane = 15° .
 - wheel base of the car = 2 m.
 - height of C. G. of the car above the inclined plane = 1 m
 - perpendicular distance of C. G. from rear axle = 0.9 m
 - speed of car = 54 km/h.
 - coefficient of friction between tyres and roads = 0.6
 - brakes are applied to all the four wheels.

Determine :—

- (i) distance travelled by the car before coming to rest
- (ii) time take in doing so if,
 - (1) the car is moving up the plane and
 - (2) the car is moving down the plane.

5. (a) Following data relate to a Cone clutch : 10
- maximum and minimum contact surface radius = 150 mm and 125 mm respectively ;
 - semi cone angle 20° ;
 - coefficient of friction = 0.25 ;
 - allowable normal pressure = 140 kN/m^2 .
- For uniform intensity of pressure determine,
- (i) the axial load and
 - (ii) power transmitted at 1000 rpm.

- (b) In an epicyclic gear of the sun and planet type as shown in **figure**, the PCD of the internally toothed ring is to be 224 mm and the module 4 mm. When the ring D is stationery, the spider A, which carries three planet wheels C of equal size, is to make one revolution in the same sense as the sun wheel B for every five revolutions of the driving spindle carrying the sun wheel B. Determine suitable numbers of teeth for all the wheels. **10**



6. (a) Two parallel shafts are to be connected by spur gearing. The approximate distance between the shafts is 600 mm. If one shaft runs at 120 rpm and the other at 360 rpm, find the number of teeth on each wheel if the module is 8 mm. Also determine the exact distance apart of shafts. **8**
- (b) A cam rotating clockwise at a uniform speed of 1200 rpm has the following data for the follower motion with UARM – **12**
- Follower to complete outward stroke of 25 mm during 120° of cam rotation
 - dwelling for 60°
 - return to its initial position during 90° of cam rotation
 - dwelling for the rest of the period. Taking a suitable scale draw the displacement, velocity and acceleration curves with respect to time.
7. Write short notes on (any four) :— **20**
- Internal expanding brake
 - Classification of cams
 - Reverted gear train
 - Centrifugal clutch
 - Prony brake dynamometer.
-